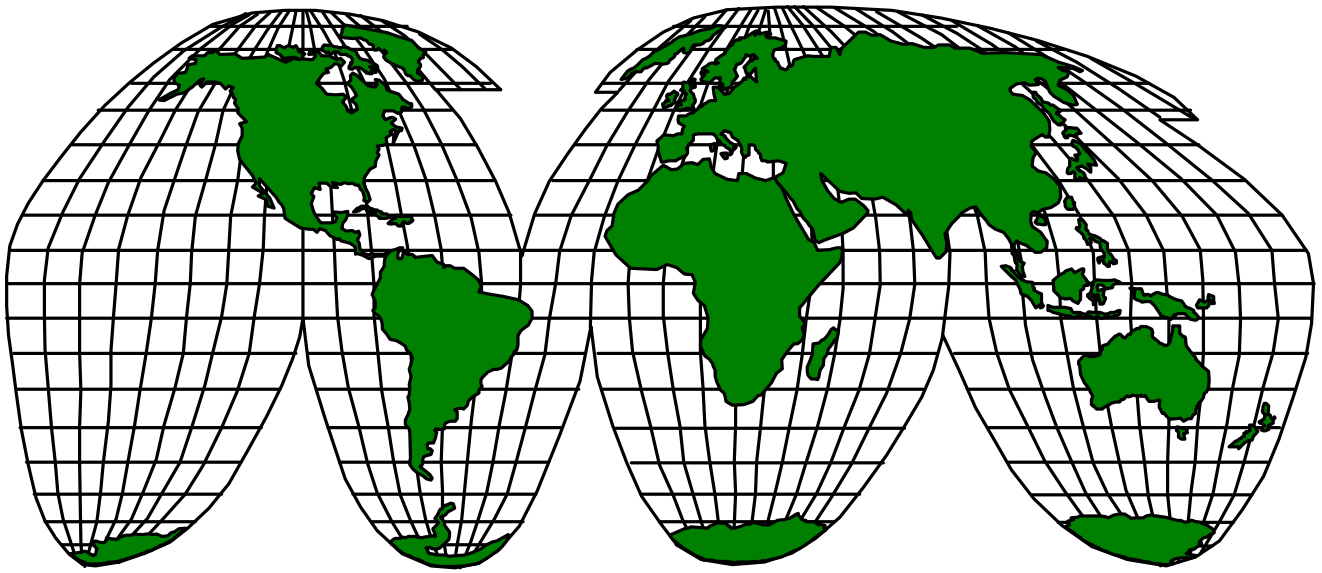
Lessons Learned In PL Risk Assessment



Historical (Informal) Risk Mgmt

ADVANTAGES:

- **simple/intuitive**
- **consensus is often sought**
- **utilizes experience and engr judgment**
- **successful**

Historical (Informal) Risk Mgmt

REASONS TO CHANGE:

- **more at stake from mistakes**
- **inefficiencies/subjectivities**
- **lack of consistency**
- **need to consider complicated factors**

Risk Management Objectives

Reduce risks

Reduce costs

Increase understanding

- **decision support tool**
- **resource allocation tool**

Risk Management Process

I. Perform a risk assessment

assign values to all conditions and activities

II. Establish Risk Targets

benchmarking

III. Allocate Resources Accordingly

Desired Output

Pipeline XYZ, having conditions...

A

B

.

.

...and operated as...

D

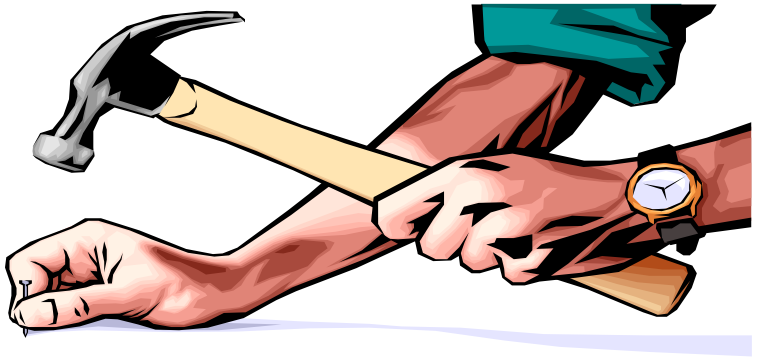
E

.

.

...has a risk of failure of _____

Tools



HAZOPS

event trees

fault trees

FMEA

scenarios

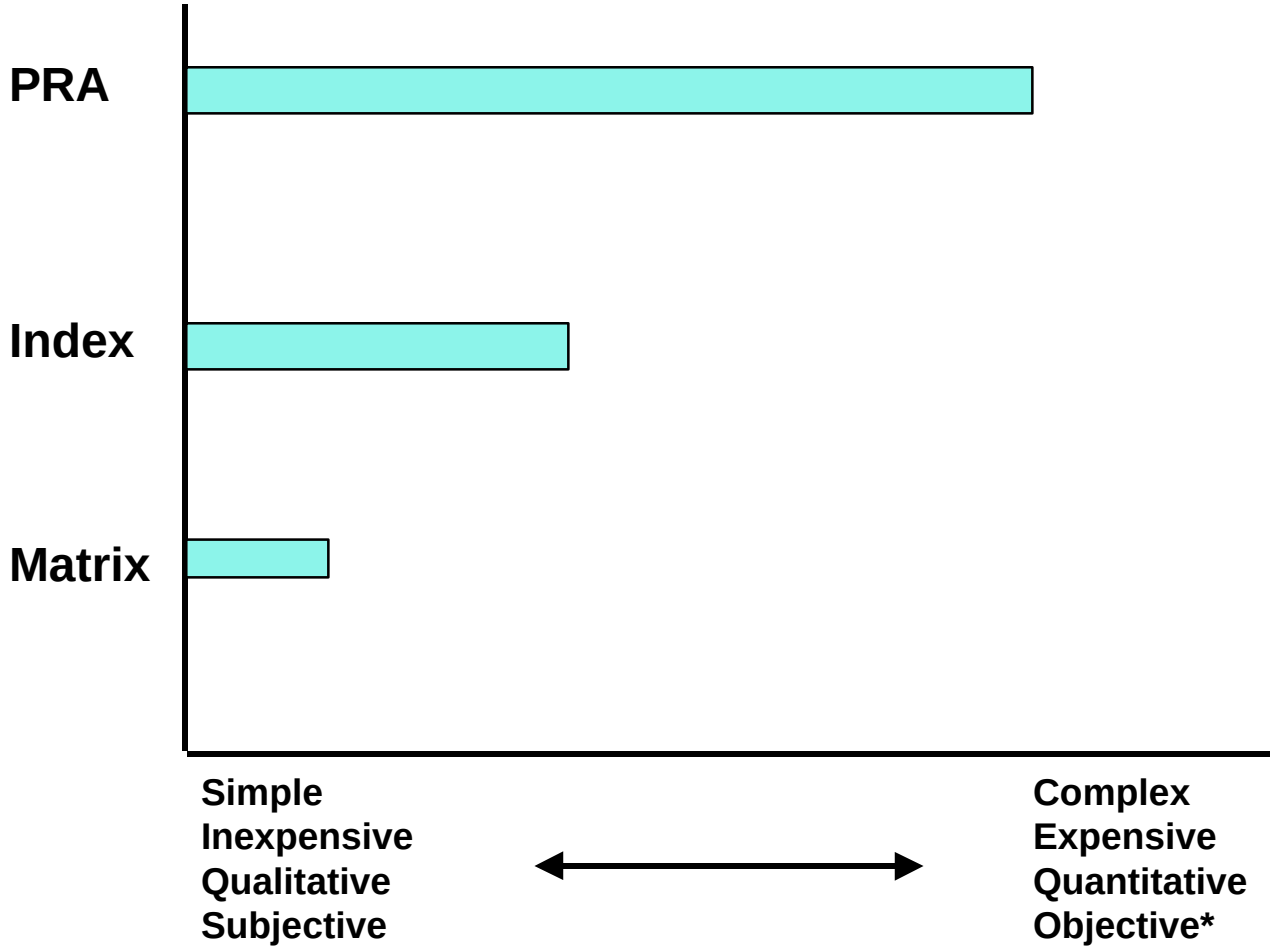
The Role of Statistics

Probably the single best decision support available

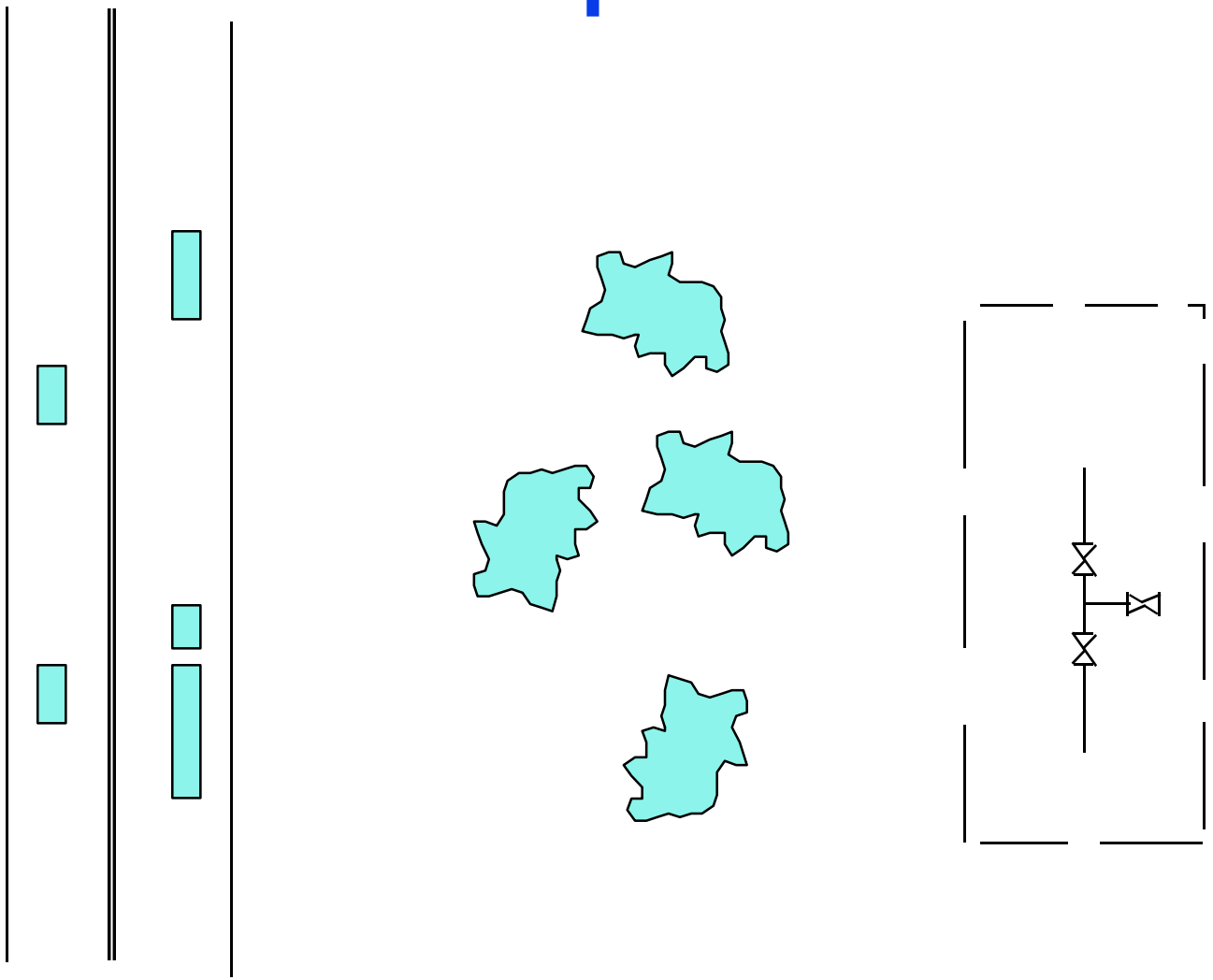
Problems:

- **Historical data usefulness in current situation**
- **Small amount of data in rare-event situations**

Risk Assessment Models



Traffic Impact Event



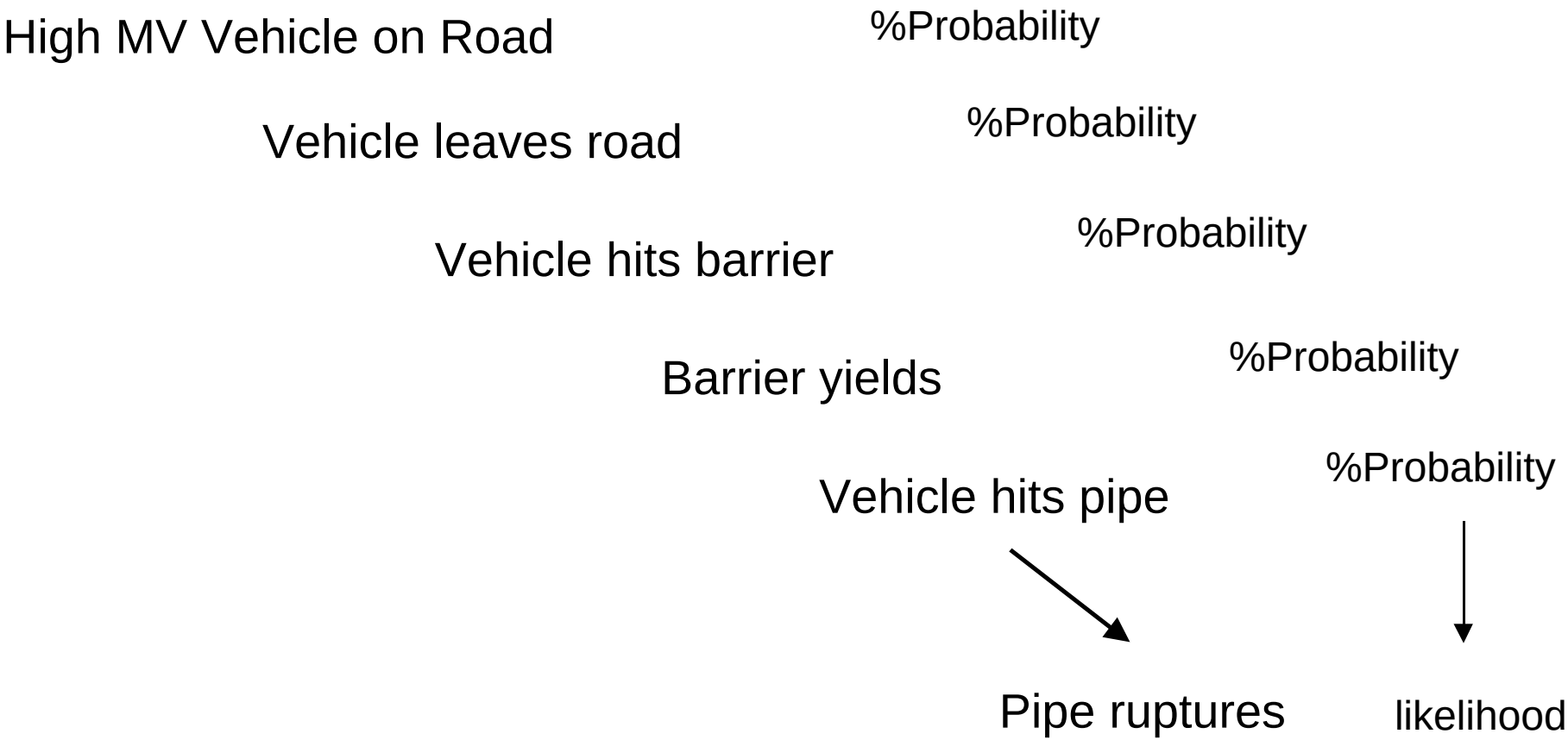
Simple Matrix

Probability

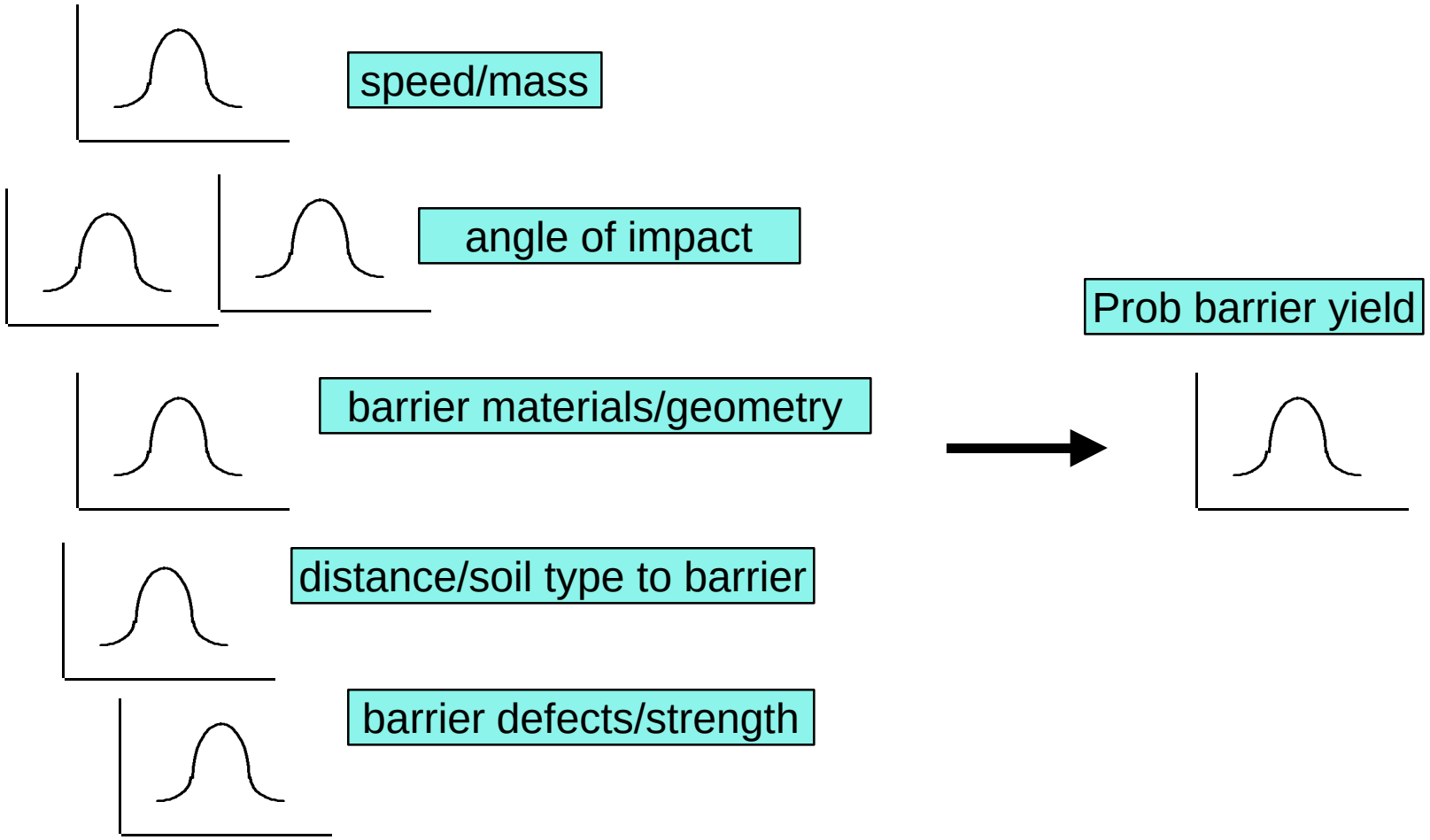
High	5	6	7	8	9
	4	5	6	7	8
Med	3	4	5	6	7
	2	3	4	5	6
Low	1	2	3	4	5
	Low		**Med**		**High**

Consequence

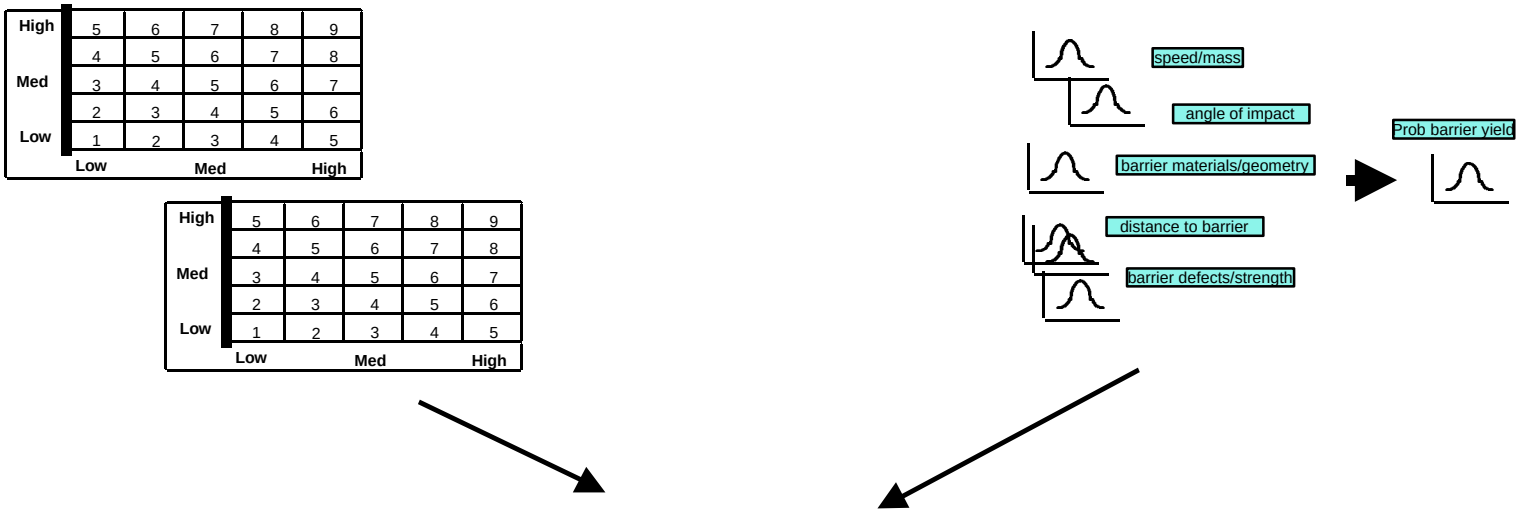
PRA Event Sequence



PRA Factor Analysis



Index Analysis



- Most important factors
- Relative contribution to risk picture

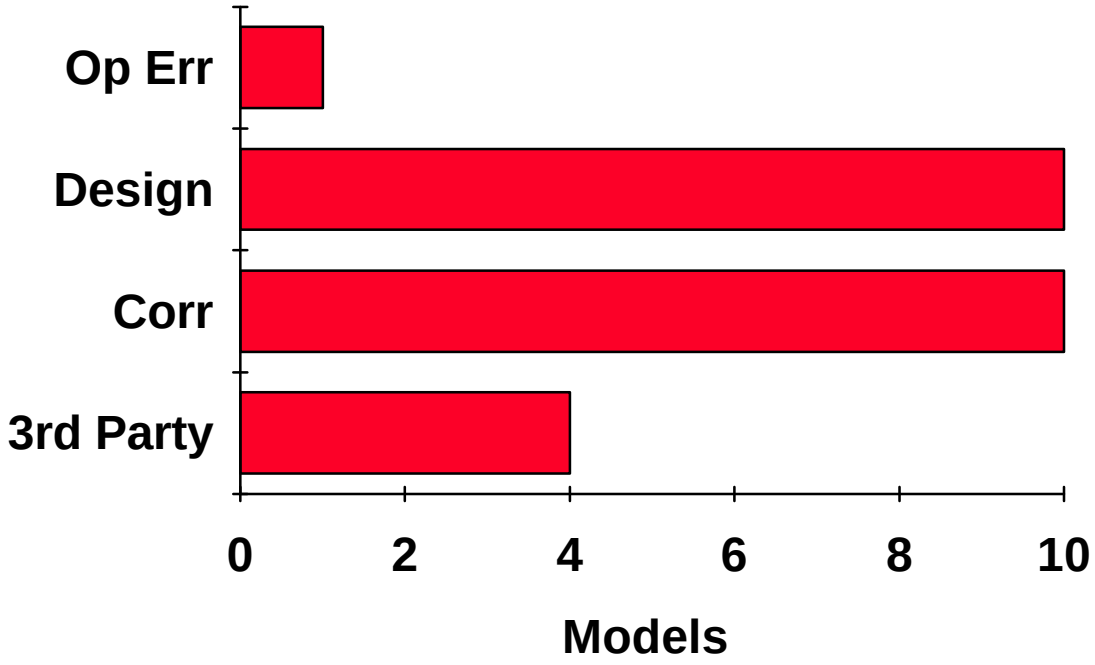
Index Model

Indexing Analysis

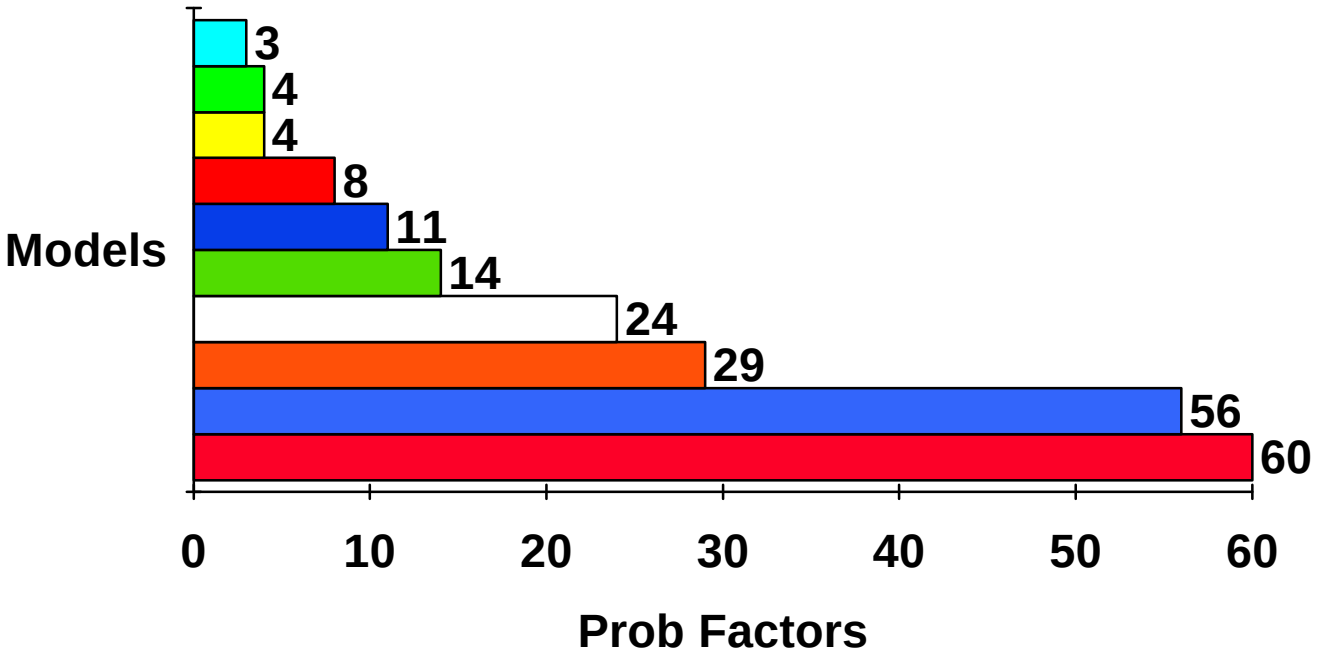
traffic volume/type	**30%**
barrier type	**40%**
distance from roadway	**30%**

Review of 10 Indexing Models

Failure categories covered



Number of Probability Factors Considered



Favorite Prob Factors

Coating type/condition

Age

Wall Thickness

Hydrotest

Leak Hist

CP Hist

Some Other Common Prob Factors

- SCC
- Pressure
- Diameter
- Soil Condition
- Joint Type

More Exotic Prob Factors

Transition Temp

Op Training

Drug Testing

Goodwill Factor

Public Education

Manufacture Plant

Sabotage Hist

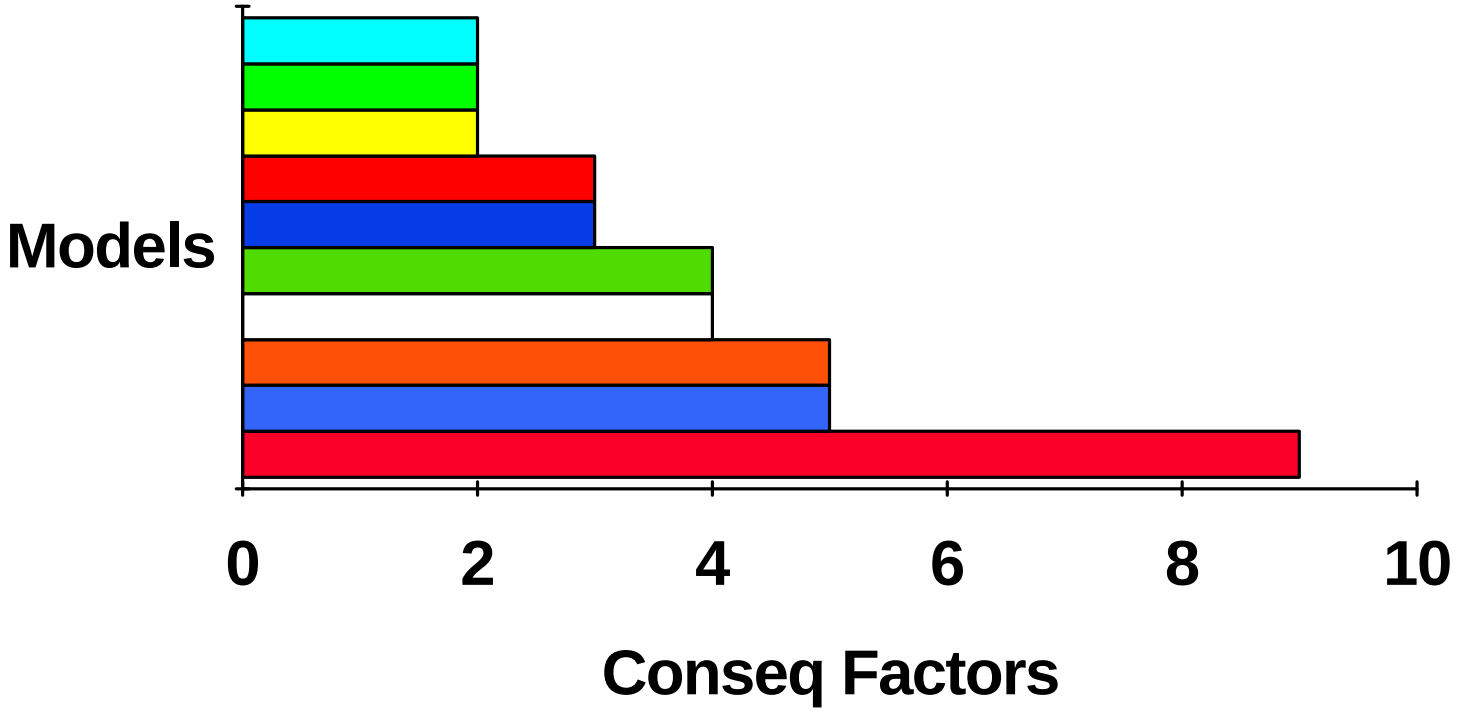
Repair Access

Mining Activity

Cycles

AC Power

Number of Consequence Factors Considered



Most Common Conseq Factors

Class location (or equivalent)

Security of Thruput

A Very Simple Model

Pipeline Index = C + W + A + Cl + S

where

- **C = Coating**
- **W = Wall Thickness**
- **A = Age**
- **Cl = Class location**
- **S = Security of Thruput**

Issues in risk modeling

sources of information

cost/benefit of the analysis

“objectivity”

reproducible results

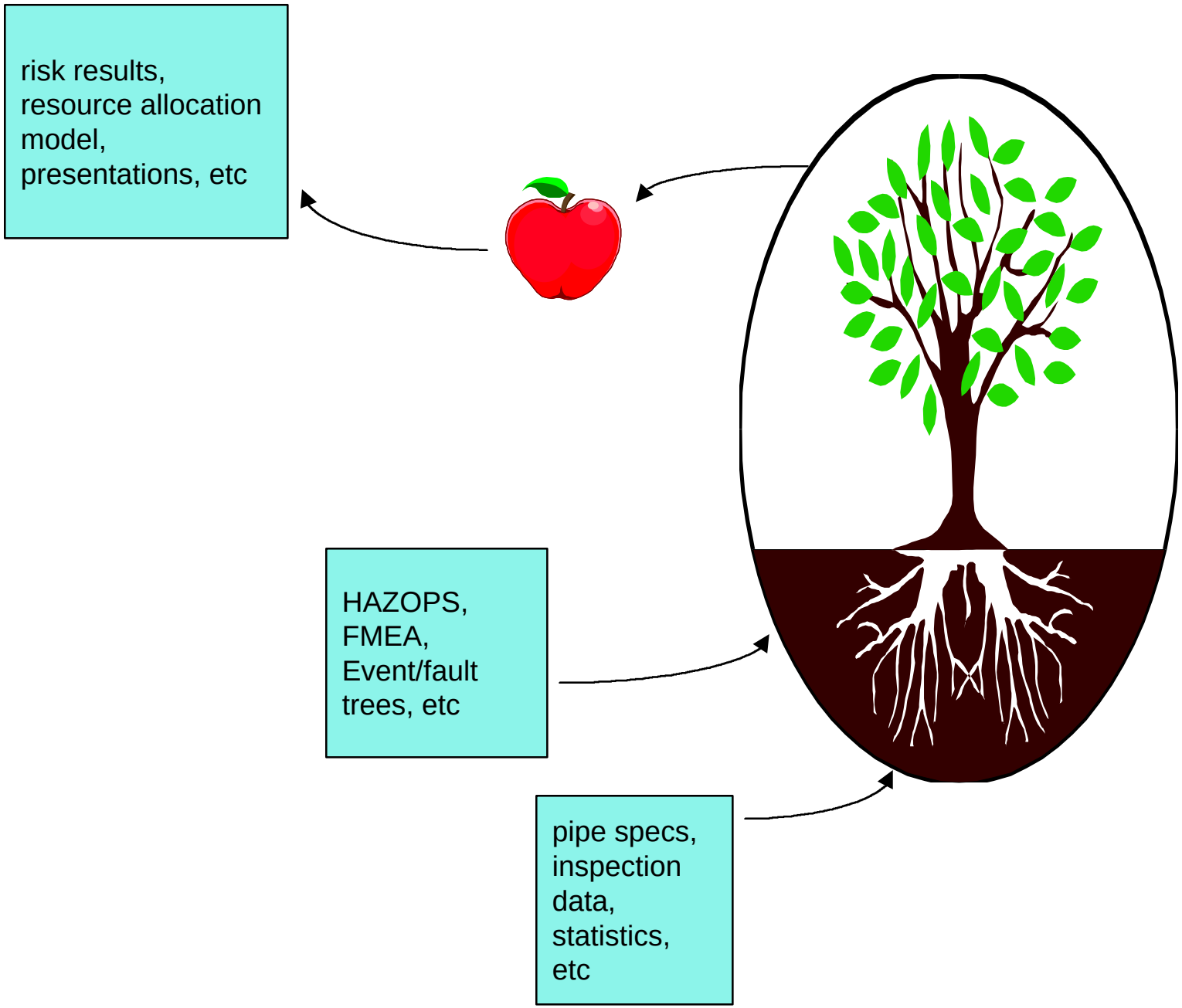
defensible

Lessons Learned

1. Work from general to specific
2. Think 'organic'
3. Avoid complexity
4. Use computers wisely
5. Build the program as you would build a new pipeline
6. Study your results

I. Work from general to specific

II. Think “organic”


risk results, resource allocation model, presentations, etc
HAZOPS, FMEA, Event/fault trees, etc
pipe specs, inspection data, statistics, etc

III. Avoid complexity

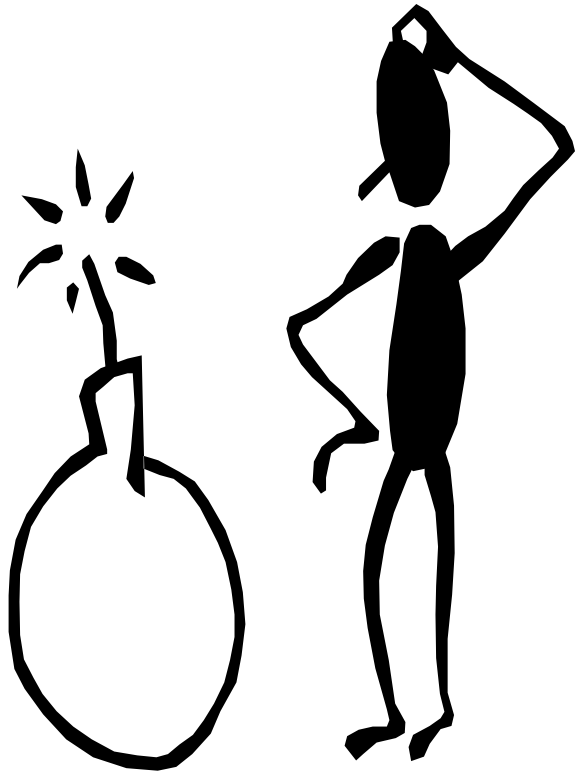
IV. Use computers wisely

V. Build the program as you would build a new pipeline

Project Phases

- Conceptualize
- Route selection
- Design
- Material procurement
- Construction
- Commissioning
- Project completion files

Picking a PL Risk Assessment Approach



Balancing

Identifying an exhaustive list of contributing factors

vs

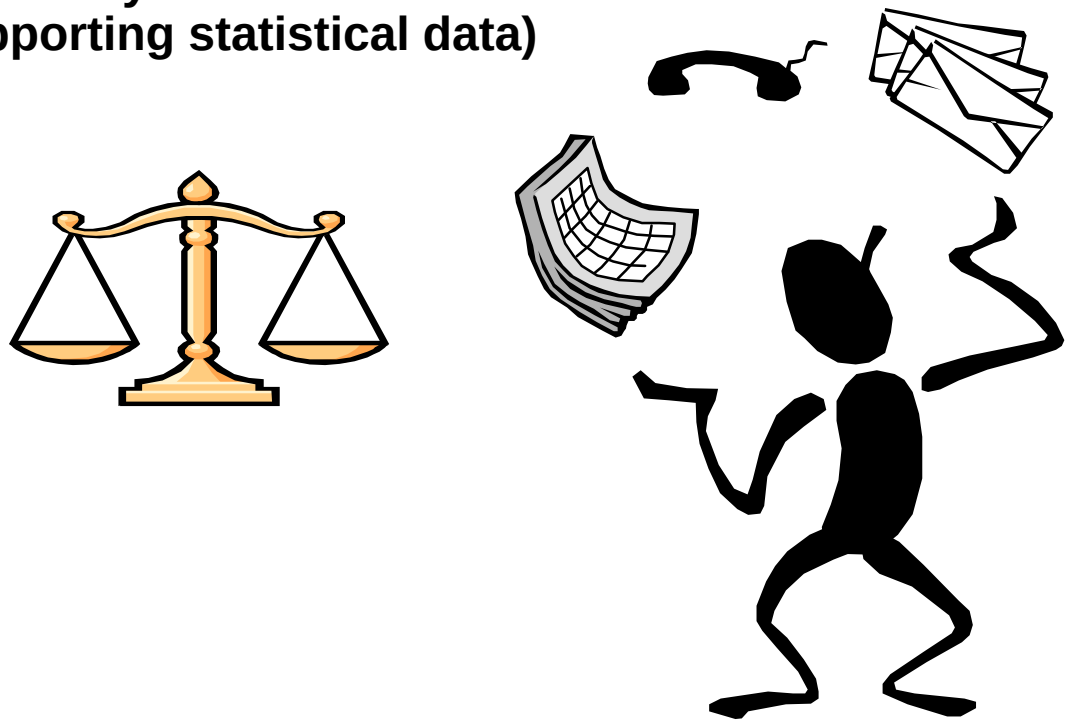
Choosing the critical few to incorporate in a model

(comprehensive vs complex vs simple)

Balancing

"Hard" data and engineering judgement

(how to incorporate widely-held beliefs which do not have supporting statistical data)



Balancing

Uncertainty

vs

Statistics

(how much reliance to place on predictive power of limited data)

Balancing

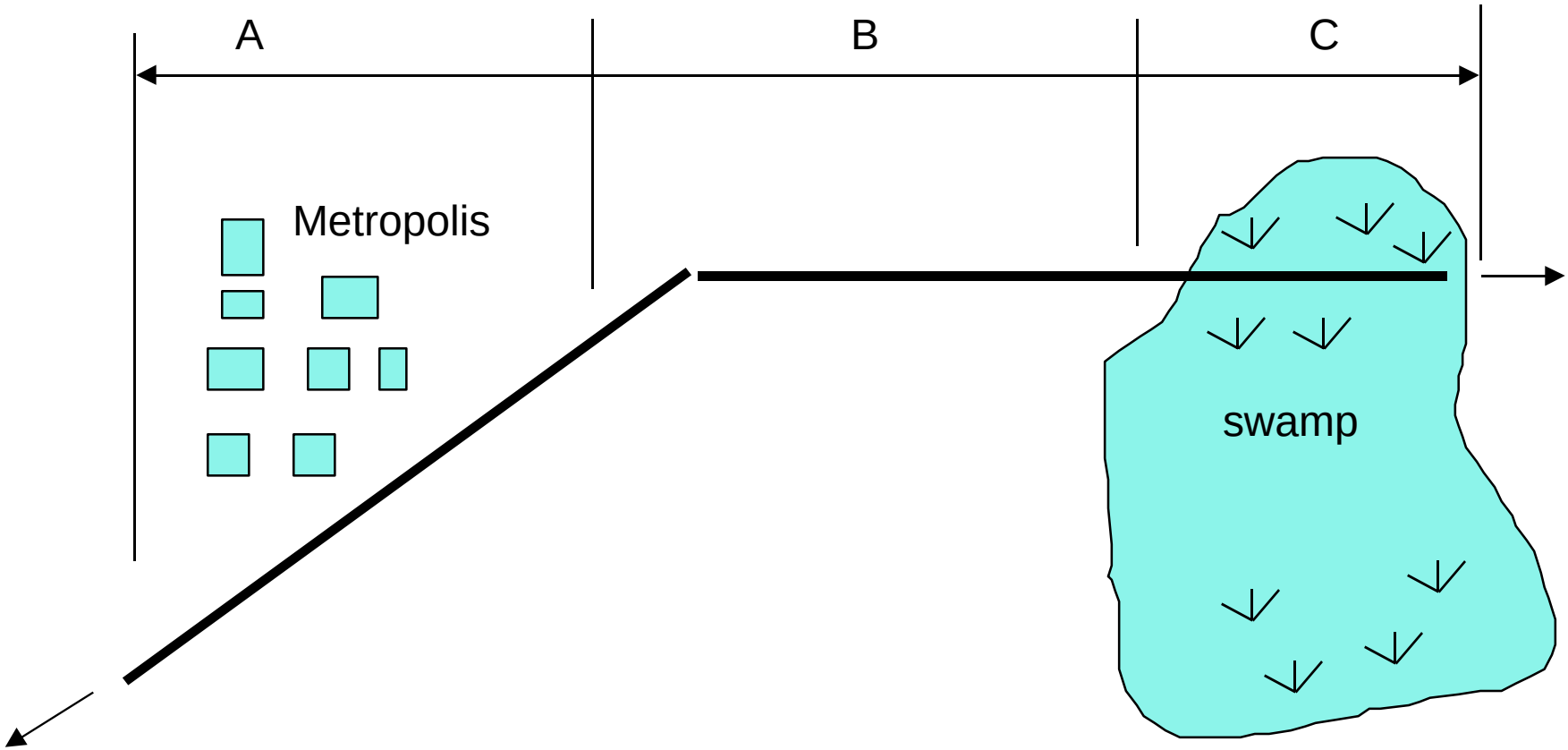
Flexibility

vs

Situation-specific model

(ability to use same model for variety of products, geographical locations, facility types, etc)

Sectioning



The Ideal Risk Model

simple/easily understandable

comprehensive

accurate predictor

expandable

cheap

Risk Assessment Program Costs (initial)

Study A: 200 miles of pipeline and 8 stations in 5 months

Study B: 700 miles of pipeline and 20 stations per month

Project Completion

- documenting all aspects
- assigning responsibilities
- measuring improvement
- re-visiting processes
- management of change

(see DOT documentation, “Admin Elements”)

Lessons Learned

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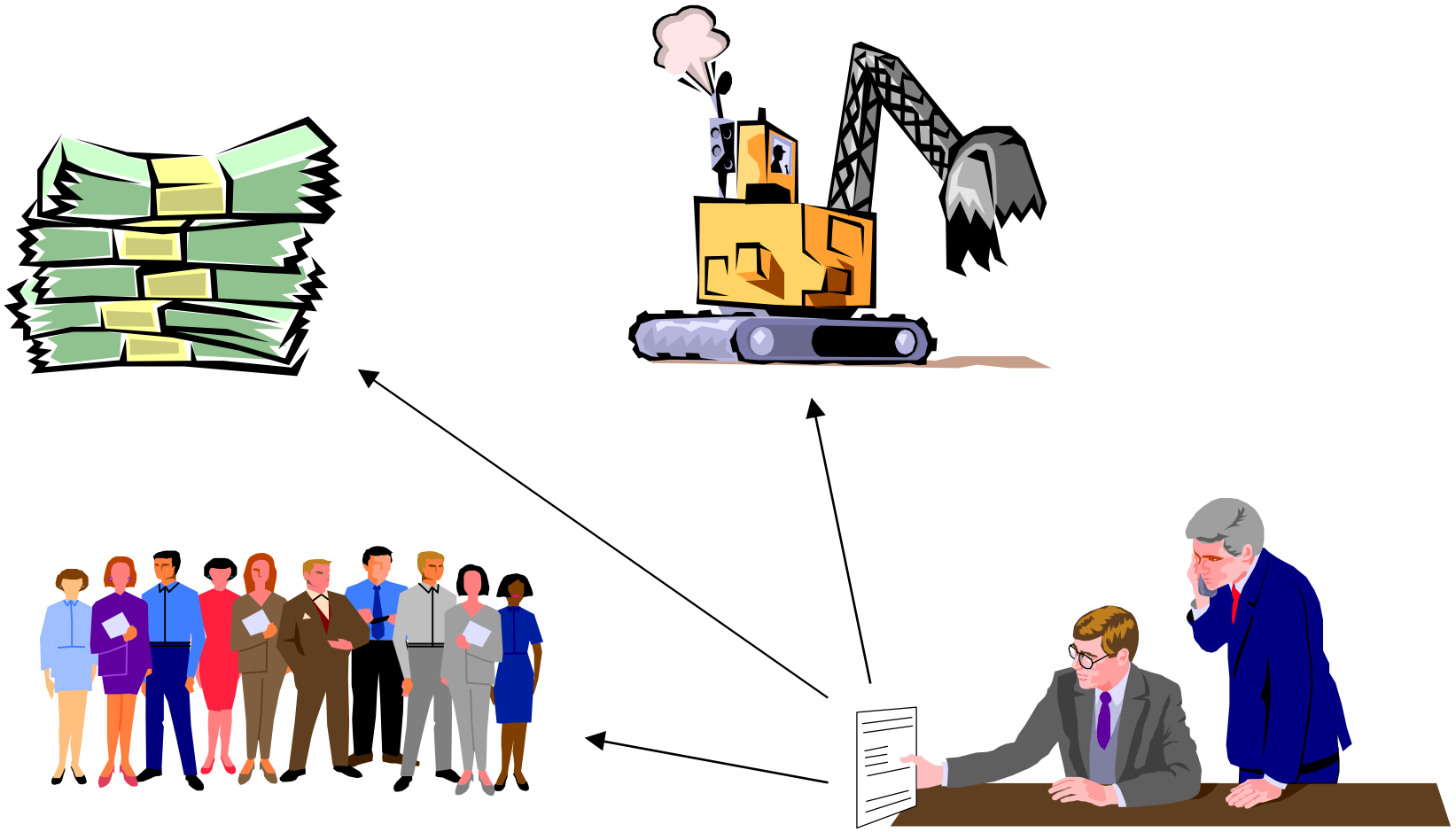
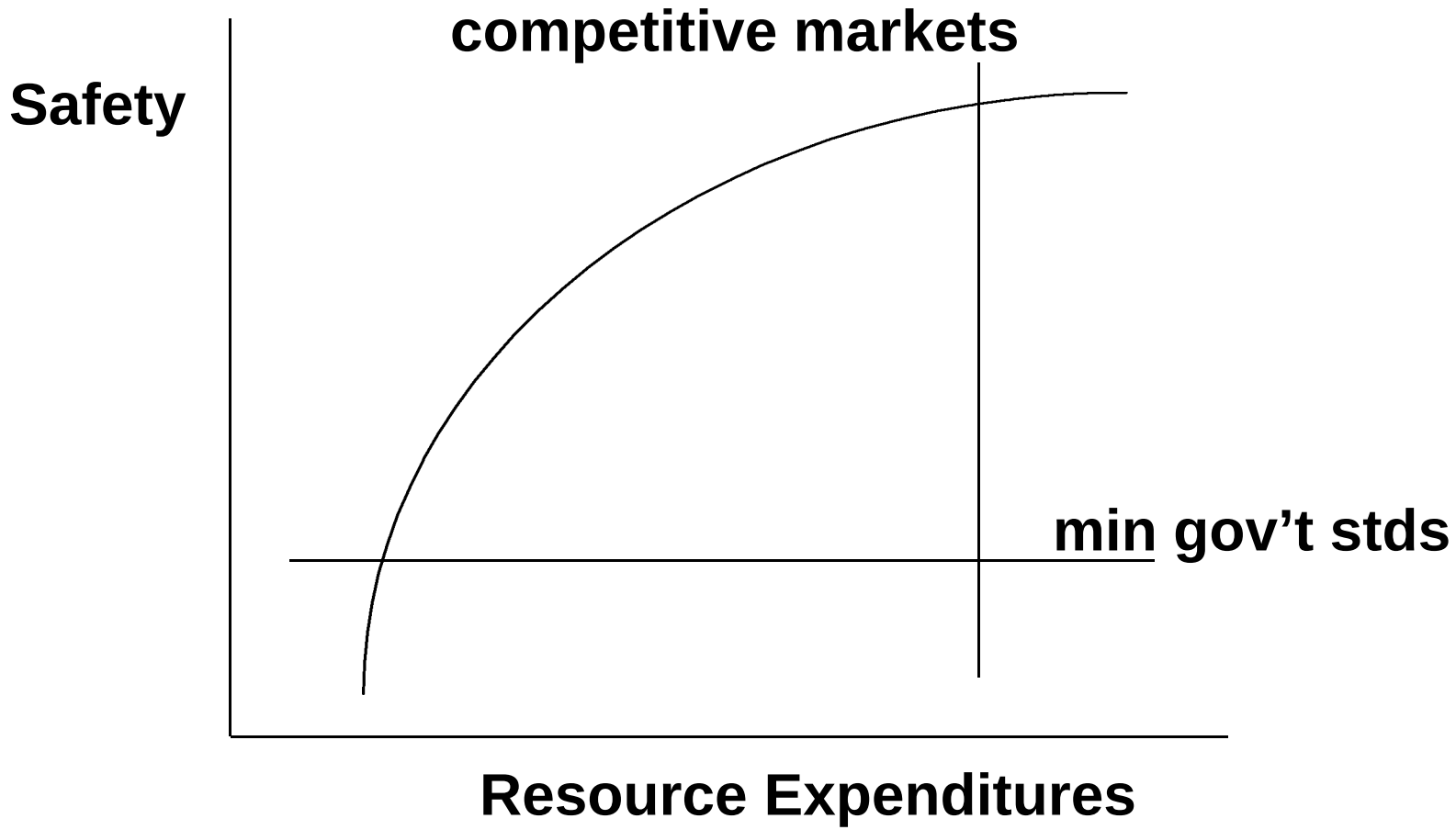
6. Study your results

VI. Study your results

Resource Allocation Modeling




competitive markets
Safety
min gov’t stds
Resource Expenditures

Management Options

Resource Allocation Choice	Cost Impact	Risk Impact
Increase Public Education	+ $4000	- 0.8%
Perform Close Interval Survey	+ $11000	- 2.6%
Reduce Air Patrol	- $7600	+ 1.1%
Perform Hydrostatic Test	+ $67000	- 8.2%

Conclusions

- **RA/RM should be cost effective**
- **Few roadmaps to follow**
- **Manage as any large project**
- **Risk Management is a valuable tool**

If you don't have a number,

you don't have a <u>fact</u>,

you have an <u>opinion</u>.